

REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Applicant asserts that the present invention is new, non-obvious and useful. Prompt consideration and allowance of the claims is respectfully requested.

Amendments to the Specification:

Examiner objected to the drawings on the ground that Fig. 11 is missing. In fact, there was a typographical error in the specification, in which reference was made to four figures showing schematic presentations of "a method for identifying materials located in the VOL." There are only three such figures (7, 8, and 9); apparently, the description was by accident cut-and-pasted one time too many. Thus, the figure described in the specification as "Figure 11" should in fact be Figure 10 (as it appears in the figures). The superfluous description has been deleted from the specification.

In addition, a large number of typographical errors and errors in English grammar have been corrected. The status of patent applications cited in the original specification has been updated. Applicants respectfully assert that these corrections add no new matter.

Amendments to the Claims:

Status of Claims

Claims 1 – 20 are pending in the application. Claims 1 – 20 have been rejected. Claims 1, 2, 5, 6, 8, 11, 13 – 18, and 20 have been amended. Typographical and grammatical errors in claims 2, 11, and 13 – 18 as originally filed have been corrected. Claim 3 has been cancelled without prejudice or disclaimer. In making this cancellation without prejudice, Applicants reserve all rights in these claims to file divisional and/or continuation patent applications.

Applicants respectfully assert that the amendments to the claims add no new matter.

CLAIM OBJECTIONS

Examiner requested that semicolons appearing in line 2 of claim 1, line 2 of claim 15, and line 2 of claim 16 be replaced with colons. The claims have been amended according to Examiner's request.

CLAIM REJECTIONS

35 U.S.C. § 112 Rejections

Claims 16 and 20 were rejected on the grounds that they claim both a method and an apparatus. The claims have been amended to make it clear that only a method is being claimed. In particular, the additional step of "obtaining remote XRD means as defined in claim 1 or any of its dependent claims" has been added to claim 16, and the mention of the Cell-X detector in claim 20 has been amended from a description of the apparatus to inclusion in a separate step of the method claimed.

35 U.S.C. § 102 Rejections

Examiner rejects claims 1 – 13, 15 – 17, and 19 on the grounds as having been anticipated by Husseiny et al. in U.S. Patent 5,600,303 (hereinafter '**303**'). Examiner asserts that '**303**' teaches a remote XRD means for identifying a material in a VOI comprising a plurality of X-ray sources and a plurality of X-ray detectors.

Applicants respectfully submit that in fact '**303**' does not teach a VOI at all. '**303**' teaches a method for probing the entire content of, e.g. a suitcase (cf., e.g., Figures 5 and 18 of '**303**'); column 13, lines 6-7, speaks of "*thorough interrogation of suspicious baggage*"; that is, the entire suitcase is probed. Furthermore, '**303**' specifically states (column 19, lines 30-34) that "*diffraction detection station 200 serves the dual purpose of detecting the presence of an explosive and providing a three-dimensional (effectively, 2½ dimension) image of the baggage.*" That is, the apparatus disclosed in '**303**' is explicitly designed to probe the entire volume of the piece of baggage being probe, rather than a VOI located within that volume.

In contrast, the present invention is specifically designed to define a VOI, which can be (and normally will be) a specific volume *within* a larger container, e.g. a piece of luggage. For example, in Figure 2, the VOI (24) is clearly shown as a specific region within container (25), and is described as such in the accompanying description on page 8 of the application. Thus,

'303 does not (and by its nature cannot) identify or probe a VOI, but rather an entire container that may or may not contain a VOI within.

Furthermore, the plurality of X-ray sources in '303 is designed for a completely different use than the plurality of X-ray sources used by the present invention. As illustrated in Figure 5 of '303, the plurality of X-ray sources are used to scan a plurality of regions within the volume being probed; that is, each X-ray source and associated detector is used to probe a different volume. In fact, the purpose of multiple X-ray sources in '303 is specifically described (column 21, lines 4-6 and 12-15) as being to increase the rate at which luggage is scanned and to "*probe the entire item*" (column 21, line 30).

In the present invention, the plurality of X-ray sources is directed at a *single* volume, and is used to obtain a more reliable profile (angular and energetic) of X-ray scattering from that single VOI. For example, Figure 4 illustrates an embodiment comprising three X-ray sources, and as can be seen in the figure. As described on page 9 of the application, "*Fig. 4 hence illustrates a system wherein a plurality of shots are taken. . . by a plurality of X-ray generators. . . . Each shot is taken such that the beam passes through the VOI.*" The device disclosed in '303 lacks this ability.

Since the device disclosed in '303 is neither designed to nor able to identify or probe a VOI as defined in the present invention, and since the purpose of having a plurality of X-ray sources in the present invention is fundamentally different than the purpose served by the multiple X-ray sources in '303, and furthermore since '303 lacks the ability to probe a VOI with multiple X-ray beam, applicants respectfully submit that the present invention is *not* anticipated by '303 and that the above arguments traverse Examiner's objections to claims 1 – 13, 15 – 17, and 19.

Examiner rejects claims 2 – 13 on the ground that they are anticipated by '303. It seems that in these cases, the basis for Examiner's objection is that they depend on an independent claim that was rejected on the grounds of anticipation by '303. Applicants respectfully submit that in light of the arguments above regarding claim 1 of the present invention, the general basis for rejection of claims 2 – 13 is traversed as well. Both '303 and the present invention teach an apparatus for detecting dangerous or contraband items that are to be taken onto a passenger aircraft. Since the primary means by which such items are taken aboard a passenger aircraft is either on the person of a passenger or in his carry-on luggage, it

necessarily follows that the apparatus would have to be adapted for detection of dangerous or contraband items, and for searching a passenger or his carry-on luggage. Indeed, U.S. Patent 7,317,390 (granted to Huey and Wolff on Jan. 8, 2007, i.e. after '303) claims (claim 1) a system for detecting "*threat objects concealed by the passenger*" attempting to board an aircraft as well as (claim 1) a "*baggage imaging system*," for baggage being carried by the passenger, while U.S. Patent 7,355,401 (granted to Laubacher et al. on April 8, 2008, likewise after '303) claims (claim 10) a detection system "*wherein the target compound comprises explosives, drugs, or other contraband*." These granted patents demonstrate that there is no *a priori* reason for rejection of claims for methods for detecting items of interest (specifically explosives, drugs, or other contraband) on a passenger or in his carry-on luggage, as long as the method itself is novel.

Specific responses to Examiner's comments about claims 2 – 13 follow.

Regarding claim 2, Examiner cites column 22, lines 10 – 15 of '303 as teaching that the material is selected from at least one of the group of explosives, flammable, toxic, chemical and biological warfare substances in either gas, liquid, or solid states, spores, drugs and narcotics, radioactive agents, or a combination thereof. In fact, in the cited passage, '303 teaches only explosives, and not a list of possible suspect items. Furthermore, '303 only teaches detection of explosives under specific circumstances, in which the luggage being scanned passes within a known distance of the source and detector (Figures 4 and 5), e.g. on a conveyor belt (column 21, line 28). In contrast, the present invention is capable of defining and probing a VOI via "*remote*" means (p. 4), e.g. to probe a VOI associated with a passenger who is walking in a "*reasonably wide corridor*" (p.6). As discussed above, '303 makes no provision for detecting a VOI, and must scan the entire volume of the suspect item. In the case of the present invention, the VOI is predetermined and the system identifies the substance of interest contained within the VOI.

In response to Examiner's rejection of claim 3, this claim has been cancelled.

Regarding claim 4, Examiner states that the claim is anticipated by '303, which teaches that the material is being transferred on a passenger and/or in his carry-on baggage. As explained above, any system for detecting dangerous or contraband items that are about to be taken aboard a passenger aircraft must necessarily be adapted for screening a passenger and/or his carry-on baggage, and as shown in the case of U.S. Pat. 7,317,390, such claims are not a

priori invalid. In addition, '303 discloses a device for "detecting explosives and other contraband at security check points" (column 11, lines 54 – 55). As described above, the present invention is not limited to security check points, and may be used to probe any area within the airport.

Regarding claim 5, Examiner states that '303 teaches that the XRD is any technique adapted for calculating the diffraction pattern obtained by X-ray scattering of the material. In fact, '303 does not teach "any" technique. Rather, it teaches only a single technique, namely, standard X-ray imaging in which X-ray intensity is measured along a single line. The 1-dimensional detector is shown schematically in Figure 4 of '303, and described in lines 40 – 43 of column 20, and typical spectra are shown in Figure 6. The present invention applies a completely different principle, namely, measurement of Debye-Scherrer rings; the principle of the data collection is illustrated in Figures 2, 4, and 6 of the present invention, and a typical spectrum is shown in Figure 1. It is clear that the spectra acquired during use of the present invention are of a different form than those of '303, and that the technique is in fact different. Collection of Debye-Scherrer rings rather than 1-dimensional spectra enables more accurate determination of the spectrum, and hence more sensitive detection (both in terms of higher signal-to-noise ratio and in terms of correct identification of suspect substances within the VOI). Since '303 uses a "*1-dimensional detector*" and specifically uses this type of detector "*to minimize the length of time required to collect the entire spectrum*" (column 20, lines 40 – 42), Applicants respectfully submit that the type of detection used in the present invention cannot be considered to have been anticipated by '303, and that '303 cannot be considered to teach XRD as "any technique adapted for calculating the diffraction pattern." In order to clarify the difference between the present invention and '303, claim 5 has been amended to define more closely the type of XRD being claimed in the present invention.

Regarding claim 6, the same arguments made above regarding claim 5 apply: the present invention acquires a Debye-Scherrer ring for each value of θ , as opposed to the 1-dimensional spectrum acquired by the apparatus taught in '303. In addition, the passage cited by Examiner (column 38, lines 14-29) makes no mention of measurements of the energy profile of the scattered X-rays; nor, as far as Applicants have been able to determine, does any other part of '303. Claim 6 has been amended in order to make this difference more clear.

Regarding claim 7, Examiner states that '303 teaches a 2D X-ray detector. In the passage

cited, the detection under discussion is a 2D transducer array for an ultrasonic system, not an X-ray detector. In several places (e.g. Figures 2 and 6, column 20, lines 40 – 42 as cited above), '303 specifically teaches a "*1-dimensional*" detector in which X-ray intensity is only measured along one axis. The second dimension of detection in '303 is position determination of the scattering source, as shown in Figure 5. In contrast, in the present invention, the detector itself measures X-ray intensity in two dimensions, as illustrated, e.g., in Figure 4. The use of 2D detector 46 is described on p. 9 of the present application. A 2D detector is required for acquisition of the full diffraction pattern (Debye-Scherrer image) of scattering from a *single* point (VOI), as shown, e.g., in Figure 6. Thus, Applicants respectfully submit that not only does '303 not teach a 2D detector in the sense that the present invention claims, such a detector cannot in principle even be applied to the apparatus.

Regarding claims 8 and 9, Examiner states that '303 is adapted to measure at least a portion (or the central portion) of the XRD patterns. Again, the text of column 24 cited by Examiner refers not to X-ray detection but to ultrasound detection. In column 22, '303 specifically refers to a 1-dimensional spectrum ("*I* vs. *2 θ* "); a "portion" of such a spectrum would thus be measurement of a restricted range of values of *2 θ* . In contrast, the present invention measures the Debye-Scherrer *rings*. As shown in Figure 1, a "portion" of this spectrum means measuring only a part of the full 360° ring (i.e. within a certain angle about the scattering axis). Even when a "portion" of the spectrum is collected, there need not be any limitation on the range of *2 θ* measured. Claim 8 has been amended in order to clarify the difference between the present invention and '303.

Regarding claim 10, Examiner states that '303 teaches XRD means adapted to identify moving VOIs. As explained above, '303 does not teach VOIs (as the term is used in the present invention) at all. Furthermore, in the passage cited, '303 teaches a rotating platform in which the object being probed is rotated "*90 °, then 180 °, then 270 °. The rotation occurs until all quadrants of the object are interrogated. . . . This is to carefully specify the location of the threat.*" Thus, '303 is not teaching identification of a VOI moving in an arbitrary direction but rather moving the piece of baggage being scanned in a predetermined, specific manner, in order that the scan encompass the entire volume of the baggage. In contrast, the present invention teaches identification of a VOI moving along an arbitrary pathway independent of the location of the apparatus. This adaptation of the apparatus is illustrated in

Figure 3, in which the moving VOI is for example (p. 8) *"an object being transferred or a passenger walking with his carry-on luggage."* Thus, moving VOI taught in the present invention (in contrast to '303) is not necessarily an object being moved under the control of the apparatus, but may include an object moving in an arbitrary direction with arbitrary speed, e.g., on p. 7 the VOI is described as being *"transferred along a non-predetermined course (e.g. incidental movement of a passenger with his carry-on luggage in a corridor)."* The invention disclosed in '303 makes no provision for this type of moving volume.

Regarding claims 11 and 12, again, as '303 makes no mention of or provision for a VOI in the sense that the term is used in the present invention, it is not possible for '303 to include a provision for notifying the user of the presence of a VOI. In the present invention, "surveillance" and "follow up" refer to tracking the motion of the VOI *"before identifying its nature (p.5),"* e.g. *"by various video techniques or other means adapted for online image processing (p. 7),"* prior to apprehension of the suspect or to confiscation of the suspect baggage. Furthermore, the present invention has a provision for the case in which *"the system has not absolutely identified the material as hazardous, but a possibility for the existence of such material does exist,"* in which case *"a special alert will be given to the operator"* (p. 12) without necessarily providing any kind of general alarm that would lead to the apprehension of the suspect. In contrast, the invention disclosed in '303 has no provision for "follow up" or "surveillance" in this sense, given that it is designed to be used *"at security check points (column 11, line 56),"* and that in the invention therein disclosed, *"the function of the security check point is treated as an integral process (column 13, lines 13 –14).* The only form of "surveillance" or "follow up" available in '303 in the case of suspicion but not positive identification is apprehension and hand searching (column 20, lines 24–25).

Regarding claim 13, the alerting system described in the text cited from '303 describes a local alarm system (audio, visual, and video). The alarm system claimed in the present invention is a remote alarm that can inform a user that the detection apparatus is now in an alarm status, even in the case where the volume being searched for a VOI (e.g. a corridor) is at a location distant from the operator.

Regarding claims 15 and 16, Examiner states that '303 teaches a method that anticipates the method disclosed in the present invention. There are several fundamental differences between the method herein claimed and the method claimed in '303. The primary difference

is that '303 has no means of detecting a VOI as defined in the present invention. Moreover, in '303, the X-ray spectrum comprises "*a series of lines a fixed scattering angle*" (column 21, lines 55-56), while in the present invention, the X-ray spectrum comprises "*a set of images of XRD patterns (i.e., rings)*" (p. 10). Unlike '303, the method disclosed in the present invention produces a full set of Debye-Scherrer images, which provides means for more accurate determination of the composition of the materials within a VOI than the standard spectrum obtained by the method disclosed in '303. Furthermore, '303 obtains the 1-dimensional XRD pattern via a position-sensitive detector and locates the suspicious material by this means, whereas the present invention obtains a 2-dimensional XRD pattern that comprises the full Debye-Scherrer image via a pixelated 2-dimensional detector. The method of '303 provides a 1-D XRD pattern immediately, whereas the method herein disclosed determines the 1-D XRD pattern from the 2-D Debye-Scherrer rings that are acquired directly. The method of the present invention provides more accurate spectra and hence more sensitive and accurate means for identifying and locating substances of interest (explosives, drugs, contraband, etc.). Claims 15 and 16 have been amended to make these differences more clear.

Regarding claim 17, as with the previous claims, the XRD spectra obtained by the method taught in '303 are 1-D spectra acquired directly by the instrument, unlike those of the present invention. In the present invention, the spectra acquired by the instrument are full Debye-Scherrer patterns, which are converted to standard 1-D spectra in a subsequent step. As above, the method disclosed in the present instrument is fundamentally different from that taught by '303; the apparatus disclosed in that invention is not capable of obtaining the type of spectrum obtained by the method herein disclosed. Thus, once again, Applicants respectfully submit that the current method has *not* been anticipated by '303, since its steps are not realizable by '303 whether obtained as described in the patent or by obvious modifications thereof.

35 U.S.C. § 103 Rejections

Examiner rejects claims 14, 18, and 20 as unpatentable over '303 in light of U.S. Patent Application 2006/0067471 (hereinafter '**471**'). Applicants respectfully submit that even with a detector of the type taught by '**471**', it would *not* be obvious to one skilled in the art how to produce the present invention from an apparatus of the type taught by '303. As discussed in

detail above, two of the essential differences between the present invention and the prior art are (a) its use of Debye-Scherrer patterns for increased accuracy over standard 1-D spectra and (b) its use of multiple X-ray sources in order to locate a VOI. Neither '303 nor '303 as modified with the detector of '471 is capable of identifying a VOI; e.g. paragraph 0045 of '471 describes its use in baggage inspection, and describes scanning the entire volume of the baggage: "*The baggage is mounted on trolley 84, and X-rays are emitted from source 82 through the baggage.*" Furthermore, neither the detector of '303 nor that of '471 is capable of acquiring full Debye-Scherrer patterns as described in the present patent and shown schematically in, e.g., Figure 3. The second dimension of the detector taught in '471 is its *depth*, that is, location of multiple detection elements along the direction of propagation of the X-ray beam (see Figure 5). The image of the object is determined from the path geometries of X-rays that pass through the detector along the direction of propagation of the X-ray beam emanating from a single source. Claim 15 of '471 defines it as a device for "*scanning an object having an arbitrary geometry,*" i.e., an object the position of which is already known, not for locating a particular volume. Thus, while it is true that the invention disclosed in '471 can provide an energy profile, it cannot provide a 2-dimensional representation of the full Debye-Scherrer image. Indeed, as with '303, '471 only provides a 1-dimensional spectral measurement. The basis of the present invention is to obtain the complete Debye-Scherrer spectral image (as illustrated, e.g., in steps (74) through (76) of the procedure outlined in Figure 7) and subsequently to convert it to a standard powder spectrum (step (77) of the same procedure). This ability significantly increases the accuracy of the identification because, unlike '303 (even with the addition of the detector taught in '471), the number of photons collected by the pixelated 2-d detector of the present invention is at least 2-3 orders of magnitude greater. A further distinction between the present invention and the prior art is the use of multiple X-ray sources to image a *single* VOI (see Figures 4 and 5). This arrangement cannot be implemented in '303 whether or not it uses the detector of '471. Applicants therefore respectfully submit that claims 14, 18, and 20 of the present invention are *not* anticipated by '303 in view of '471.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the arguments presented by Examiner have been traversed and that the pending claims are therefore deemed to be allowable. Their favorable reconsideration and allowance is respectfully requested.

APPLICANT(S): Zeev Harel et al.
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Should Examiner have any question or comment as to the form, content or entry of this Amendment, Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

A fee for a three month extension of time is believed to be due for this submission and is being paid via credit card. Please charge any additional fee required or credit any overpayment to the Deposit Account of the undersigned, Account No. 500601 (Docket No7057-X08-050).

Respectfully submitted,

/Paul D. Bianco/

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